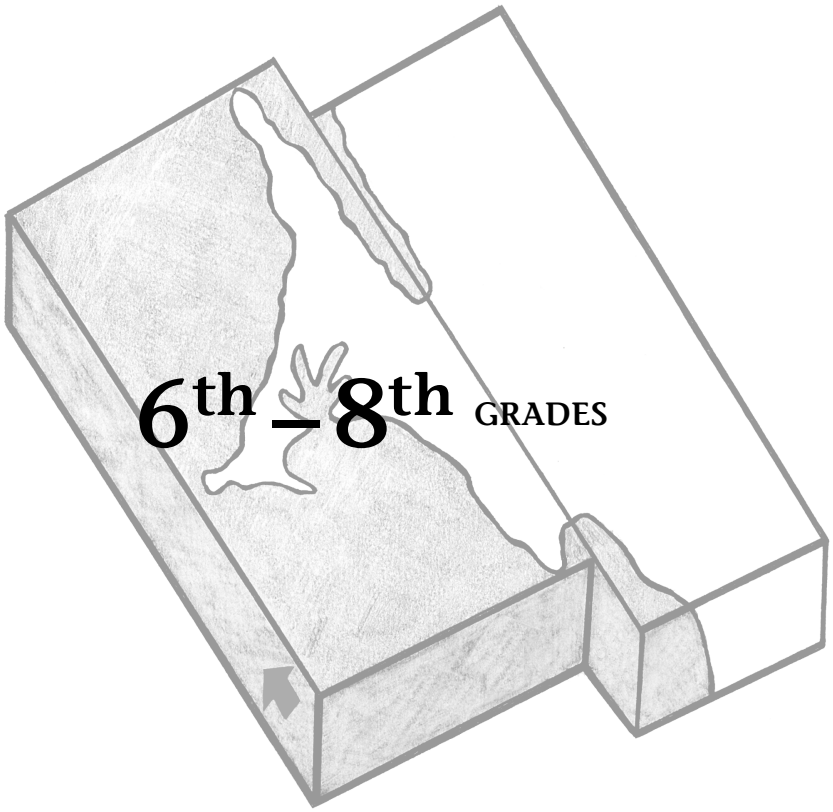
Creating
COASTAL
STEWARDSHIP
through Science

# Uncovering the San Andreas Fault

## *at Point Reyes National Seashore*



**6th – 8th GRADES**

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EXXON

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Point Reyes National Seashore Association

## Publishing Information



This curriculum guide was funded with grants through the National Park Foundation.



The listing of a resource in this curriculum does not presume its endorsement by the National Park Service.

This guide may be obtained by participating in a teacher workshop at Point Reyes National Seashore or through a teacher in-service training at your school.

Teachers are encouraged to offer their feedback by filling out the enclosed evaluation form or contacting Point Reyes National Seashore directly.

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# Preface

The intent of these guides is to provide middle school students with the opportunity to observe natural processes at Point Reyes National Seashore so they might take a greater interest in environmental stewardship and science. Teachers from 15 area schools developed and field-tested 7 "Creating Coastal Stewardship through Science" guides for classroom and field trip use. Each guide is carefully designed to facilitate a hands-on learning experience using science and the environment. Natural resources such as Pacific gray whales, northern elephant seals, tule elk, California quail, Douglas iris, and the San Andreas Fault are highlighted because they are easy to identify and to observe. All activities are linked to the California State Science Standards (2000) and the National Science Standards.

You may use this guide alone or in conjunction with other guides. We highly recommend that whenever you use a guide, you use the pre-visit activities to fully prepare the students for the field trip. These activities address student safety, wildlife observation techniques, equipment use, field journal development, and concepts that need to be taught prior to the Park visit. Use of the post-visit activities is also critical to the learning process because they guide the students in making scientific deductions and in developing their environmental stewardship ethics.

Following this preface, you will find background information on the National Park Service and an overview of Point Reyes National Seashore. To provide your students with a better understanding of the place they will be visiting, we recommend you share this information with them. For an in-depth overview of the National Park Service, visit our website at **www.nps.gov**.

Point Reyes National Seashore provides outstanding opportunities for learning about natural and cultural resources. There are also exceptional educational opportunities provided by Park partners such as the Point Reyes Bird Observatory, Audubon Canyon Ranch, and Point Reyes National Seashore Association. To learn more about the Park and our partners, visit our website at **www.nps.gov/pore**.

# THE NATIONAL PARK SERVICE

***The National Park Service cares for special places saved by the American people so that all may experience our heritage.***

## Experience Your America


Olympic National Park

On August 25, 1916, President Woodrow Wilson signed the act creating the National Park Service, a new federal bureau in the Department of the Interior responsible for protecting the 40 national parks and monuments then in existence and those yet to be established.

This "Organic Act" of 1916 states that "the Service thus established shall promote and regulate the use of Federal areas known as national parks, monuments and reservations … by such means and measures as conform to the fundamental purpose of the said parks, monuments and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."


Golden Gate National Recreation Area

The National Park Service still strives to meet these original goals, while filling many other roles as well: guardian of our diverse cultural and recreational resources; environmental advocate; world leader in the parks and preservation community; and pioneer in the drive to protect America's open space.


Mesa Verde National Park

The National Park System of the United States comprises over 379 areas covering more than 83 million acres in 49 states, the District of Columbia, American Samoa, Guam, Puerto Rico, Saipan, and the Virgin Islands. Although not all parks are as well known as the Grand Canyon and Yellowstone, all are areas of such national significance that they have been included in the National Park Service—ancient ruins, battlefields, birthplaces, memorials, recreation areas, and countless other wonders. Point Reyes National Seashore is one of ten national seashores.


Grand Canyon National Park

The future of the National Park System lies in understanding and protecting its meanings, values, and resources. Each part of the system represents the United States and a part of our heritage. Preservation of individual sites and the entire system will ensure the essence of quality remains in our lives and the lives of all future generations.

# Point Reyes National Seashore


Bruce Farnsworth

***Point Reyes National Seashore was established to preserve and protect the natural and cultural features and natural ecosystems along the diminishing undeveloped coastline of the western United States. Located just an hour's drive from a densely populated metropolitan area, the Seashore is a sanctuary for countless plant and animal species. With half of Point Reyes National Seashore designated as wilderness, it provides a sanctuary for the human spirit—for discovery, inspiration, solitude, and recreation—and a reminder of the human connection to the land.***


Sue Van Der Wahl

Point Reyes National Seashore comprises over 71,000 acres, including 32,000 acres of wilderness area. Estuaries, windswept beaches, coastal scrub, coastal grasslands, salt marshes, and coniferous forests create a haven of 80 miles of unspoiled and undeveloped coastline located just an hour's drive from an urban area populated by seven million people. Abundant recreational opportunities include 140 miles of hiking trails, backcountry campgrounds, and numerous beaches.

The San Andreas Fault separates the Point Reyes Peninsula from the rest of the North American continent. Granite bedrock found here and not found again until the Sierra Nevada range suggests that the Peninsula is geologically dynamic. According to geologists, the land that is now called Point Reyes has moved some 300 miles northwest over a period of 100 million years and is still moving.


Rich Stalkup

As wildland habitat is developed elsewhere in California, the relevance of Point Reyes as a protected area with a notably rich biological diversity increases. Over 45% of North American avian species and nearly 18% of California's plant species are found here. Point Reyes also contains some examples of the world's major ecosystem types. For this reason, and because Point Reyes is dedicated to the conservation of nature and scientific research, it was recognized in 1988 by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Man and the Biosphere program and named as part of the Central California Coast Biosphere Reserve.


Bruce Farnsworth

The cultural history of Point Reyes spans many lives and ways of living with the land. The Coast Miwok people are the first known residents of this peninsula. Archeologists have identified over 100 village sites in the Seashore and cultural traditions are still celebrated in the Park annually. Overlapping the Coast Miwok were Mexican land grantees, lighthouse keepers, and lifesaving station crews. To this day, agricultural operations that were built near the turn of the twentieth century continue within the Seashore's pastoral zone.


NPS Collection

Educational Opportunities at

# POINT REYES NATIONAL SEASHORE

***Point Reyes National Seashore provides an outdoor classroom and learning laboratory for the study of geological and ecological processes and changing land-use values in which a greater understanding of and caring for public lands can be fostered.***

## Ranger-led Curriculum-based Education Programs

Reservations for Ranger-led programs are requested in writing and assigned on a first-come, first-served basis. Visit **nps.gov/pore** for the reservation form and calendar.


NPS Collection

**K-2** Students explore the natural resources of the Seashore with Park Rangers in the Bear Valley area or in their classroom.


NPS Collection

**3-4** Students immerse themselves in the Coast Miwok culture by completing a comprehensive curriculum and visiting the Coast Miwok cultural exhibit, Kule Loklo.


NPS Collection

**4** Students revisit the days of early lighthouse keepers while operating the original Point Reyes Lighthouse clockwork with Park Rangers.


NPS Collection

**5** Students study the oceanic influences on the Point Reyes Peninsula by completing a classroom curriculum and viewing gray whales and elephant seals with Park Rangers.

**6-8** Students participate in Ranger-led stewardship activities such as habitat restoration, water quality monitoring, and beach cleanups.

## Ranger-led Training Programs


NPS Collection

**9-12** Students become DOCENTS to assist middle school teachers with classroom teaching and use of scientific research tools on Seashore field trips (service learning credits earned).

Students become RESEARCH ASSISTANTS at the Pacific Coast Learning Center by participating in the inventorying and monitoring of Seashore resources.


NPS Collection

**Teachers** Teacher workshops are offered throughout the year for existing Park curricula and for field trip planning. Visit the Seashore's website at **www.nps.gov/pore** for a calendar of workshops.

## Classroom and Field Trip Curriculum

Based on the National and State Science and Social Science Standards

**3-4**

Teacher packets are available for field trips to the recreated Coast Miwok village, Kule Loklo, located near the Bear Valley Visitor Center.

***The "Creating Coastal Stewardship through Science" middle school curricula are available to teachers who attend a one-day workshop at Point Reyes or a teacher in-service training.***

**6-8**

Completion of the ***Identifying Resident Birds Curriculum,*** as a companion to a birdwatching field trip, will enable students to observe and identify different bird species, their habitats, and their behaviors. A visit to Point Reyes Bird Observatory will also enable students to observe bird banding and netting and to understand the most common threats to bird survival.

Completion of the ***Monitoring Creek Health Curriculum,*** as a companion to a Ranger-led creek program, will enable students to observe and understand the complexity and sensitivity of creek habitats and their role in protecting them.

Completion of the ***Discovering Northern Elephant Seals*** Curriculum, as a companion to an elephant seal viewing field trip, will enable students to observe and understand the amazing adaptations and behaviors of Northern elephant seals.

Completion of the ***Defining Habitats Curriculum,*** as a companion to a Park field trip, will enable students to observe and understand the complex land and ocean habitats of the Point Reyes Peninsula and their roles in habitat protection.

Completion of the ***Uncovering the San Andreas Fault Curriculum,*** as a companion to a geology field trip, will enable students to observe and understand the existence of the San Andreas Fault and the implications it has for area residents.

Completion of the ***Investigating Tule Elk Curriculum,*** as a companion to an elk viewing field trip, will enable students to observe and understand elk behaviors and the issues that surround their management.

Completion of the ***Observing Pacific Gray Whales Curriculum,*** as a companion to a whale watching field trip, will enable students to observe and understand gray whale adaptions and behaviors, and the factors that influence their survival.

## Educational Facilities

The **Historic Lifeboat Station** is available to educational groups for overnight use. Nightly fees are charged. Group size must be under 25 (including chaperones). Reservations are made on a first-come, first-served basis by completing the boathouse form on our website at **www.nps.gov/pore**.

The **Clem Miller Environmental Education Center** is an overnight facility available by lottery to school groups visiting for multiple-night stays September through May. The facility is used for summer camps during the summer months. Fees are charged. For information, contact Point Reyes National Seashore Association at (415) 663-1200, website **www.ptreyes.org**.

The **Pacific Coast Learning Center** is a day-use facility located on Highway 1. This facility is used by researchers and students to study the natural and cultural resources of the Seashore.

The **Bear Valley Visitor Center** is a day-use facility open to school groups Monday through Friday from 9 A.M. to 5 P.M. Exhibits on natural and cultural resources are found here. Books, brochures, and other educational materials are available.

The **Ken Patrick Visitor Center** is located on Drakes Beach, approximately 30 minutes from the Bear Valley Visitor Center. This facility is open year-round on weekends and holidays from 10 A.M. until 5 P.M. Ranger-led elephant seal programs meet at this Visitor Center. Exhibits and a 150-gallon saltwater tank are located here. Books, brochures, and other educational materials are available.

The **Lighthouse Visitor Center** is located on the outermost tip of the Peninsula, approximately 45 minutes from the Bear Valley Visitor Center. This facility is open Thursday through Monday from 10 A.M. until 4:30 P.M. (closed Tuesdays and Wednesdays). Ranger-led whale programs and lighthouse tours meet at this Visitor Center. Exhibits on maritime history and whale biology are located here. Books, brochures, and other educational materials are available.

The **Lighthouse** is located below the Lighthouse Visitor Center at the bottom of a 308-step staircase. The lens room is usually open from 2:30 P.M. until 4 P.M. Thursday through Monday or as weather and staffing permit. High winds always close the lens room. Space in the lens room is limited so reservations are required for groups. Call (415) 464-5100 to confirm existing weather conditions.

## Group Camping/Overnight Opportunities

* This listing is provided for your convenience and does not constitute a recommendation or endorsement of any of these facilities.

All overnight camping in **Point Reyes National Seashore** requires a permit and advance reservations. Group sites are very limited and in high demand. Sky, Coast, and Wildcat Camps are all backcountry campgrounds that require hiking to access them. A fee is charged. For more information, visit the Seashore's website at **www.nps.gov/pore.**

The **Point Reyes Hostel** offers a dormitory-style group cabin with a fully equipped kitchen and showers. For additional information and reservations, call (415) 663-8811 during office hours, 7:30 to 9:30 A.M. and 4:30 to 9:30 P.M.

**Samuel P. Taylor State Park,** located 6 miles east of the Seashore on Sir Francis Drake Boulevard, offers campsites for groups. A fee is charged. Reservations are highly recommended. For more information, visit the reservations website at **www.reserveamerica.com.**

**Olema Ranch Campground** is located half a mile from Seashore headquarters on Highway 1. It is privately owned. Several large group sites are available. Fees are charged. For more information, call (415) 663-8001.

The **Marconi Center** is located 8 miles north of Seashore headquarters on Highway 1. This facility is operated by California State Parks. Lodging, conference rooms, and catered meals are provided for a fee. For more information, call 1 (800) 970-6644 or visit the website at **www.marconiconfctr.org.**

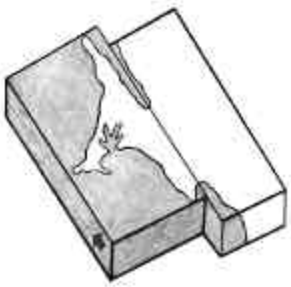
National Park Foundation

Creating Coastal Stewardship through Science

EXXON

# Uncovering the San Andreas Fault

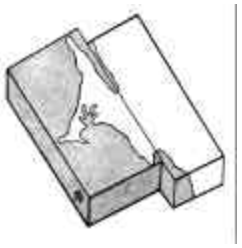
Creating COASTAL STEWARDSHIP through Science



# Uncovering the San Andreas Fault

## Teacher Preparation

# Uncovering the San Andreas Fault



**The San Andreas Fault System has moved the Point Reyes Peninsula to its present location and created many of the unique landforms in the Olema Valley. Geologists estimate this peninsula has travelled about 280 miles from Southern California. It was brought here by the movement of the North American and Pacific Plates grinding and pulverizing rock and soil within its zone, creating narrow inlets and long, straight valleys. The Pacific Plate is still traveling northwestward, changing the landscape and creating occasional earthquakes. This unique geology has formed the basis of life at Point Reyes National Seashore, contributing to our current climate, soils, waterways, and ecology.**

**Completion of this unit, as a companion to your Park field trip, will allow your students to observe a portion of the San Andreas Fault. They will observe its effects on the land, and how everyone along the Fault must learn to live with its unpredictability.**

## Considerations

**When:** Year-round.

**Where:** The Earthquake Trail is located a short walk from the Bear Valley Visitor Center parking lot. This 1/2-mile loop trail is level and paved. The optional Mount Vision activity can be completed by driving up the Mount Vision road, located approximately 20 minutes from Bear Valley.

**How:** This unit may be used independently of all other guides. If you want to use an additional guide we suggest scheduling another field visit. The "Defining Habitats" guide is available from Point Reyes National Seashore and can give students a more complete understanding of how geology and the resulting topography and soils influence ecology.

Teacher Preparation

**Weather:** The chart below lists average climate expectations based on previous years' data. The weather is subject to change quickly and can vary dramatically from different locations within the Seashore on the same day.

| | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperature | | | | | | | | | | | | |
| Normal Daily Maximum | 53 | 55 | 55 | 57 | 60 | 62 | 64 | 64 | 65 | 62 | 58 | 54 |
| Normal Daily Minimum | 41 | 42 | 42 | 43 | 47 | 50 | 51 | 52 | 51 | 48 | 45 | 42 |
| Extreme High | 78 | 85 | 80 | 92 | 94 | 99 | 96 | 96 | 103 | 96 | 81 | 79 |
| Extreme Low | 21 | 26 | 29 | 32 | 32 | 39 | 39 | 42 | 39 | 32 | 29 | 18 |
| Precipitation | | | | | | | | | | | | |
| Normal | 12.0 | 9.0 | 8.0 | 4.0 | 3.0 | 1.0 | 0.3 | 0.8 | 2.0 | 4.0 | 9.0 | 12.0 |
| Maximum | 20.0 | 16.0 | 15.0 | 11.5 | 8.0 | 4.0 | 2.5 | 6.0 | 7.0 | 13.0 | 18.0 | 19.0 |

**Seasonal Events:** Consult the chart below to assess which months may be best for a class visit to Point Reyes National Seashore.

| | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gray Whale Migration | ✔ | | ✔ | ✔ | | | | | | | | |
| Elephant Seal Breeding | ✔ | ✔ | ✔ | | | | | | | | | |
| Bird Migration | | | | | | | | | ✔ | ✔ | ✔ | ✔ |
| Coho Spawning | ✔ | | | | | | | | | | | ✔ |
| Steelhead Trout Spawning | | ✔ | | | | | | | | | | ✔ |
| Tule Elk Rut Season | | | | | | | ✔ | ✔ | ✔ | | | |
| Peak Flower Blooms | | | | ✔ | ✔ | | | | | | | |
| Tidepooling | ✔ | ✔ | ✔ | | | | | | | | | |
| Geology | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Ocean and Land Habitats | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Resident Birds | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |

## Chaperone Preparedness and Assistance

The success of your field trip will depend on your ability to actively prepare and involve your parent chaperones in the field trip activities. Without adult guidance, many of the students will not complete their field journals. It is essential that your field trip have as much structure as your classroom lessons. To accomplish this, we recommend that you assign each parent to a small group of students. Inform each parent that they are responsible for assisting their students with the field observations and with the completion of journal questions. Provide each chaperone with their own copy of the student journals and encourage them to complete it with the students. Also, have each chaperone carry a pair of binoculars and assist students with their use.



## Suggested Lesson Plan

Total time needed: 12+ hours

| PRE-VISIT | | Time Needed: 3+ hours |
|---|---|---|
| Activity #1 | What Questions Do Geologists Answer? *Students investigate questions geologists can answer through research.* | 2 hours |
| Activity #2 | How Can We Prepare for Our Visit to Point Reyes National Seashore? *Students will prepare for upcoming field visit by constructing field journals.* | 1 hour |
| Activity #3 | Safety and Stewardship Challenge *Proper behaviors around National Park resources are examined in a game format.* | 1 hour |
| | | |
| **ON-SITE** | | **Time Needed: 2-6 hrs** |
| Field Journal #1 | What Makes the Geology of Point Reyes National Seashore So Special? *Students complete their field journals while hiking the Earthquake Trail.* | 2 hours |
| Field Journal #2 | What Does a Fault Zone Look Like? *Classes with more time may choose to visit the top of Mount Vision for an amazing view of the geology.* | 4-6 hrs |
| | | |
| **POST-VISIT** | | **Time Needed: 5+hours** |
| Activity #1 | What Else Can We Learn About Information in Our Field Journals? *Multiple lesson ideas help students reinforce lessons learned on field trip.* | 2 hours |
| Activity #2 | What Is the Nature and History of the San Andreas Fault Zone? *Multiple activity sheets encourage students to think of the San Andreas in terms of the entire state and the world.* | 30 min |
| Activity #3 | What Is It Like to Be in an Earthquake? *Students take this opportunity to reflect on the human side of earthquakes.* | 1 hour |
| Activity #4 | What Earthquake Information Is Available on the World Wide Web, and Why Is It Important? *Students investigate real-time data on earthquakes around the world.* | 1 hour |
| Activity #5 | What Is Our Earthquake Safety Plan? *Students create an earthquake safety plan for home and school.* | 1 hour |



## Field Trip Logistics

| *Things To Remember* | | |
|---|---|---|
| *Students need:* | *Teachers need:* | *Chaperones need:* |
| ❒ rain gear | ❒ rain gear | ❒ rain gear |
| ❒ warm, layered clothes | ❒ warm, layered clothes | ❒ warm, layered clothes |
| ❒ gloves and hat | ❒ gloves and hat | ❒ gloves and hat |
| ❒ sunscreen and sunglasses | ❒ sunscreen and sunglasses | ❒ sunscreen and sunglasses |
| ❒ bag lunch with drink | ❒ bag lunch with drink | ❒ bag lunch with drink |
| ❒ water | ❒ water | ❒ water |
| ❒ waterproof boots or tennis shoes | ❒ waterproof boots or tennis shoes | ❒ waterproof boots or tennis shoes |
| ❒ clipboard with field journal and pencil | ❒ map with directions | ❒ map with directions |
| ❒ permission slip | ❒ pencil sharpeners and extra pencils | |
| | ❒ teacher backpack and field trip kits from Bear Valley Visitor Center | |
| | ❒ first aid kit | |
| ***Optional:*** | | |
| ❒ small backpack | ❒ small backpack | ❒ small backpack |
| ❒ binoculars | ❒ binoculars | ❒ binoculars |
| | ❒ camcorder/ camera | ❒ camcorder/ camera |

**Other Things to Remember:**

- Have students bring a bag lunch if you will be visiting during lunch time.
- If you have a student with accessibility concerns, please call the Park for suggestions.
- Students need warm, waterproof clothing most of the year. Sunscreen is needed on most days. Students should always be prepared for all types of weather.
- Have the students wear long pants and closed-toe shoes, preferably tennis shoes.
- Bathrooms, drinking water, and teaching materials (Geology Backpack, binoculars, clipboards etc.) are available at the Bear Valley Visitor Center. This should be your first stop when visiting Point Reyes National Seashore.



## Evaluation Process

We need your help! Since this guide was designed for your use, only your feedback will make it work. There is an Evaluation Form located in this Teacher Preparation section, right before the Vocabulary list.

If you prefer to be interviewed over the phone about your experience, please phone (415) 464-5139 and request to speak with the project coordinator.

In addition to the evaluation form, we encourage other types of feedback. Please send any of the following items from your students:

1. Videotape or photos of Park field trip
2. Completed student journals
3. Any completed stewardship activities, including posters, murals, newsletters, etc.
4. A class portfolio illustrating various pre-visit activities, photographs, or drawings
5. Completed classroom projects or photographs of projects

Please indicate if these items need to be returned. We will use them to create a project library, highlight classroom efforts on our website and in Park publications, and complete evaluations of student outcomes.

## Reservations

To avoid scheduling conflicts with other groups and to be notified about any unusual closures, please call the Park to notify us about your field trip date and time. See the Reservation Form following this unit overview.

## Geology Backpack Contents

A Geology Backpack is available for use at the Bear Valley Visitor Center. These are available on a first-come, first-served basis.

- ☐ Visual Aid Binder with raised topography map and historic 1906 earthquake photos
- ☐ compass
- ☐ small first aid kit
- ☐ Bird Identification Guide

also available:

- ☐ 40 binoculars
- ☐ 40 clipboards
- ☐ spotting scopes

NOTE: Binoculars and spotting scopes are very useful if you plan to use the on-site lesson plan **What Does a Fault Zone Look Like?**



## California Science Standard Links

| | "Uncovering the San Andreas Fault" Unit | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre-Visit | | | On-Site | | Post-Visit | | | | |
| | #1 | #2 | #3 | Field Journal #1 | Field Journal #2 | #1 | #2 | #3 | #4 | #5 |
| Sixth Grade | | | | | | | | | | |
| 1 | a,b,-d,f | | | a,b,c,d,e,f,-g | a,d,e,f | | a,c,-d,e,-f,g | | a,c,-d,e,-f,g | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | c | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | b,d | b,h | | b,h | b,f,g,h | d,e | b,e | | d | |
| Seventh Grade | | | | | | | | | | |
| 1 | | | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | a,b,-c,e | a | | a | a,e | c | a,b,-d | b,c | | |
| Eighth Grade | | | | | | | | | | |
| 1 | | | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | b | b | | b | b | | b | | b | |



**Acknowledgments**

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**Workshop Participants**

Terry Wright, Geologist, Sonoma State University
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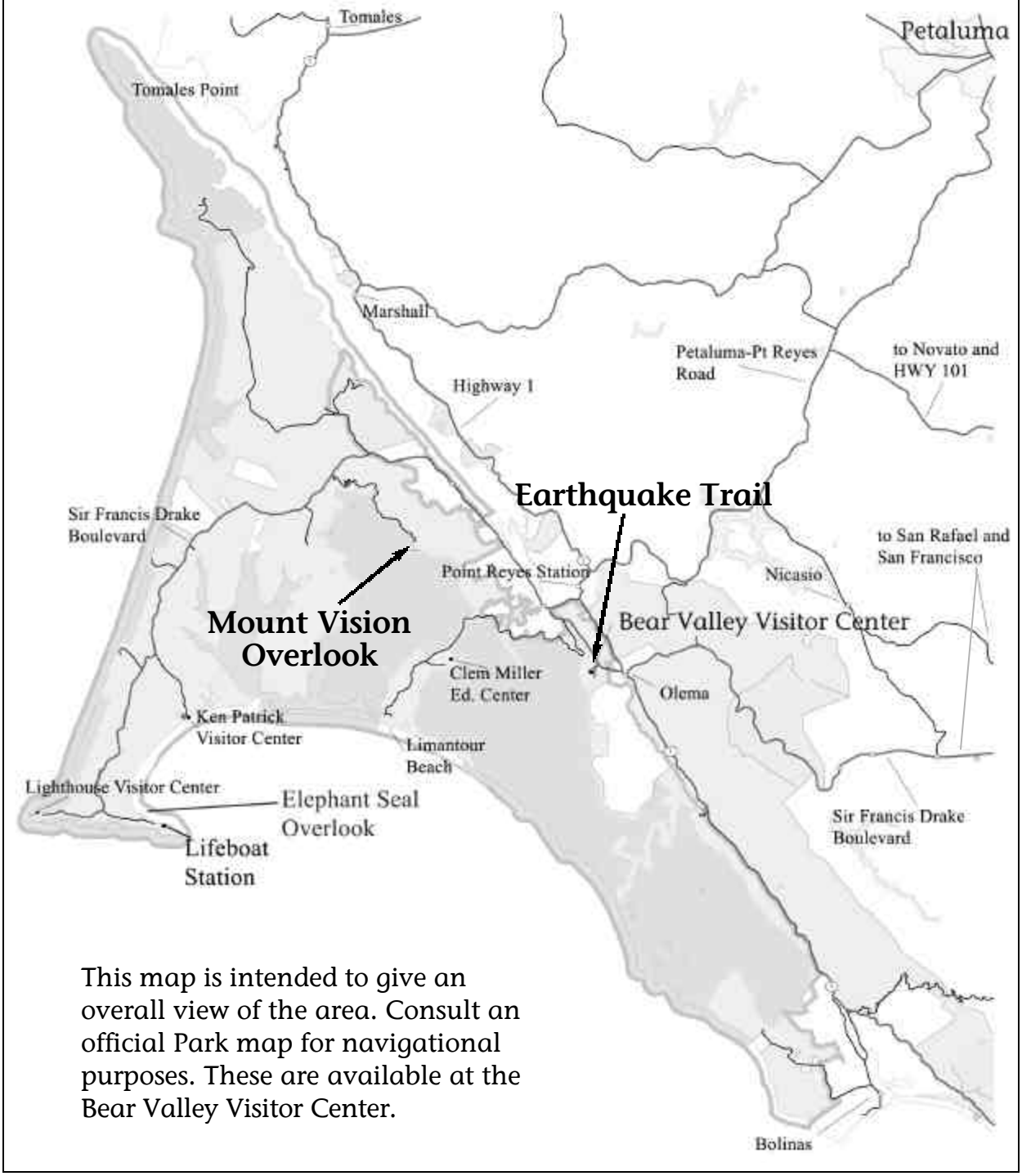
Rahel Fischer, Editor

# Point Reyes National Seashore Map

Attachment

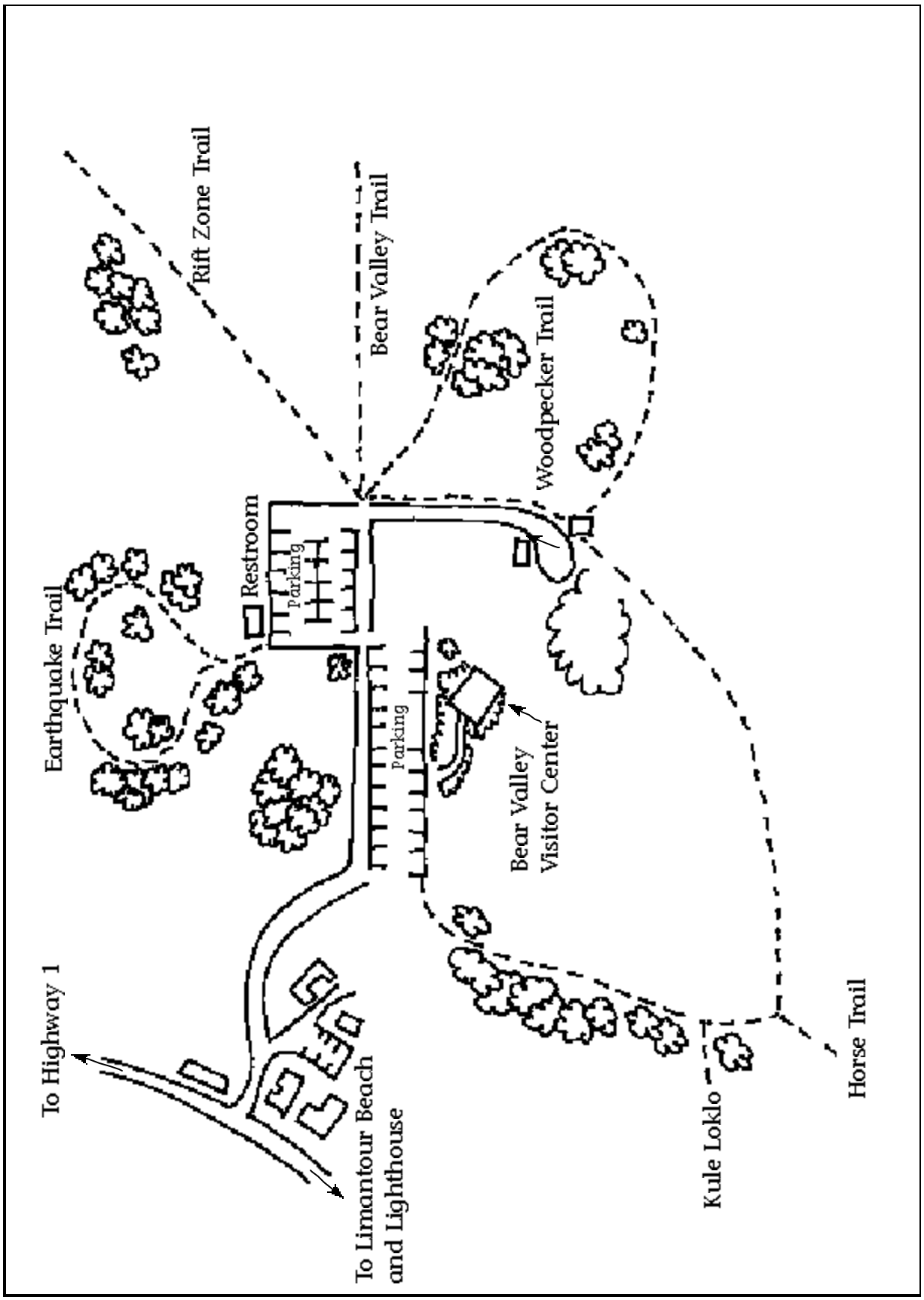



This map is intended to give an overall view of the area. Consult an official Park map for navigational purposes. These are available at the Bear Valley Visitor Center.

## Approximate Driving Times/Distances

| | |
|---|---|
| Petaluma to Bear Valley VC | 40 min./19 miles |
| Novato to Bear Valley VC | 40 min./19 miles |
| San Anselmo to Bear Valley VC | 30 min./20 miles |
| Bear Valley VC to Limantour Beach | 20 min./9 miles |
| Bear Valley VC to Tomales Point | 30 min./19 miles |
| Bear Valley VC to Ken Patrick VC | 30 min./15 miles |
| Bear Valley VC to Elephant Seal Overlook | 45 min./22 miles |

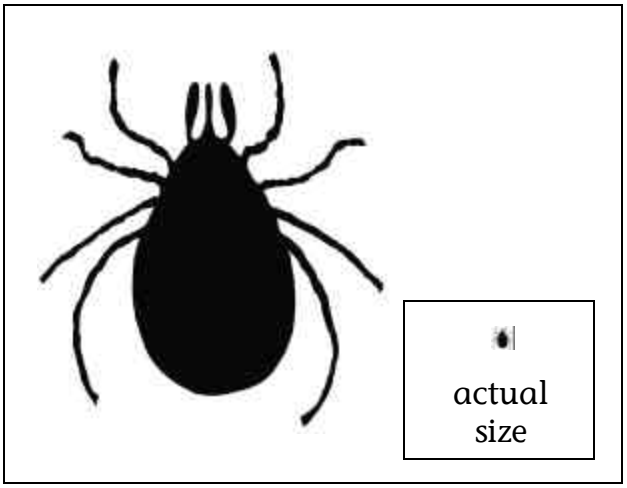
# Bear Valley Visitor Center Area Map




Attachment

# Lyme Disease, Stinging Nettle, and Poison Oak

**Lyme disease** is an illness caused by bacteria transmitted to people by tick bites. Not all ticks carry the disease. Field studies in Marin County show that 1–2% of the western black-legged ticks carry Lyme disease. Since there are several other species of ticks in Marin, the odds of a tick bite producing Lyme disease is less than 1 in 100. Even so, Lyme disease can be severe; it is important to understand the prevention and symptoms.




## Symptoms:

arthritis and joint pain
lethargy
heart problems
pain/limping
fever
kidney problems
depression
bull's-eye rash (50% of victims)

## Tick species in California include:

Western black-legged tick and Pacific coast tick (West Coast)
Lone star tick and American dog tick (throughout U.S.)

## How to avoid tick bites:

- Wear light-colored, long-sleeved clothes so you can more easily see the ticks.
- Tuck shirt into pants and pants into socks to keep ticks away from your skin.
- Stay on trails.
- Apply an insect repellent, labeled for ticks, to shoes, socks, and pants.
- Check yourself completely after a hike. Closely check any skin irritation. Ticks anesthetize the skin before biting so you'll seldom feel the original bite.

## What to do if bitten:

- Use tweezers to grasp tick at point of attachment, as close to skin as possible. Gently pull tick straight out.
- Save tick, notify your doctor.
- Don't panic— ticks need to be embedded from 24 to 48 hours to transmit bacteria. The ticks that transmit Lyme disease are usually in a developmental phase in which they are smaller than the head of a pin.

## References:

Ticks and Lyme Disease in the National Parks
Lyme Disease Foundation/**www.lyme.org**

# Lyme Disease, Stinging Nettle, and Poison Oak

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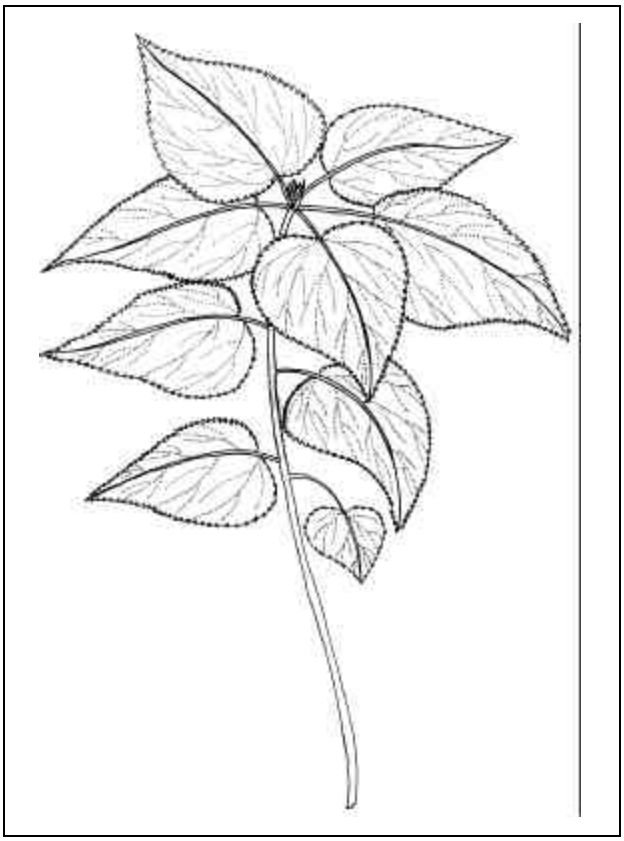
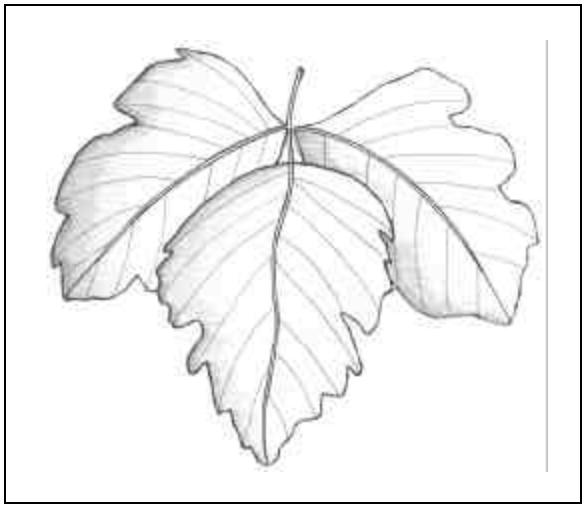


**Stinging nettle** is native to Europe, but grows at Point Reyes National Seashore. It can cause a painful rash that stings for up to 12 hours after brushing up against the plant. A topical analgesic (used to treat poison ivy or bug bites) can be applied to help alleviate the sting. Study the picture and have someone point out the plant in the Seashore to aid in its identification.

**Poison oak** usually causes an itchy rash if you are sensitive to it. You can get a rash by touching the plant, its leaves, or its roots. You can also contract poison oak by petting your dog (if the oils are on its coat) or by touching clothing that has touched poison oak. Rashes may occur several days after the initial contact with the plant. Severe rashes may affect the lungs. If you have difficulty breathing, call 911 or go to the nearest emergency room immediately. Preventive topical ointments are available to help avoid reactions to poison oak. Learn to recognize the compound leaves with a shiny appearance.





# Creating Coastal Stewardship through Science

If you are planning a trip to Point Reyes National Seashore to use this curriculum, please notify the Park to avoid conflicts with other groups and to be notified about any unusual closures. Mail this form at least 2 weeks in advance (fold in thirds and affix postage) or call (415) 464-5139, to leave a message.

Teacher Name: _____

School Name: _____

School Address: _____

City/State: _____ Zip Code: _____

School Phone: _____ School Fax: _____

Email: _____

Grade: _____ Class Size: _____

Home Phone: _____

## Field Trip Options

Monitoring Creek Health
Observing Pacific Gray Whales
Discovering Northern Elephant Seals
Defining Habitats
Investigating Tule Elk
Uncovering the San Andreas Fault
Identifying Resident Birds

## Field Trip Preferences

| Field Trip Topic | Dates (list three in order of preference) | Time |
|---|---|---|
| 1. _____ | _____ | _____ |
| | _____ | _____ |
| | _____ | _____ |
| 2. _____ | _____ | _____ |
| | _____ | _____ |
| | _____ | _____ |

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Comments

_____ Confirmation Letter
_____ Materials Sent

National Park Service
Point Reyes National Seashore
Division of Interpretation
attn: Education Program Coordinator
Point Reyes Station, California 94956



# Creating Coastal Stewardship through Science

Please help us develop and improve our programs by taking a few minutes to complete this form. This evaluation form is preaddressed, but needs to be folded in thirds and provided with postage. If you prefer, E-mail comments to: **PORE_Education@nps.gov**

Name: _____ School Name: _____

School Address: _____

City/State/Zip Code: _____

School Phone: _____ School Fax: _____

Email: _____

Class Size/Grade: _____

Date of Visit: _____ Program/Location: _____

## Getting Your Visit Set Up

Do you have any suggestions to make logistics easier? (maps, directions, reserving programs)

## Curriculum Materials

Which lessons were the most effective?

Relevance of content to my students and curriculum:

Grade appropriateness?

## Program Assessment

How does this program fit into California/National Standards and your personal education program?

Strengths/weaknesses of program?

Best part of experience?

What is the level of support at your school for this program?

What could the National Park Service do to improve your education program?

Overall, how would you respond if a colleague asked about this program?

Highly recommended  Recommended  Recommended with some qualifications  Not recommended

National Park Service
Point Reyes National Seashore
Division of Interpretation
attn: Education Program Coordinator
Point Reyes Station, California 94956



**Basalt** a fine-grained igneous rock with composition of a gabbro. Basalt makes up most of the ocean floor and is the most abundant volcanic rock in the earth's crust. Generally occurs in lava flows, but also as dikes.

**Chert** a very fine-grained sedimentary rock made of quartz. Usually made of millions of globular skeletons (containing silica) from tiny marine plankton called radiolarians. Black chert is called flint.

**Epicenter** that point on the earth's surface that lies vertically above the focus of an earthquake

**Erosion** the complex group of related processes by which rock is broken down physically and chemically and the products moved

**Estero** a semi-enclosed body of coastal water within which seawater is diluted with freshwater (estero: Spanish for estuary)

**Fault Zone** faults generally consist of a zone, sometimes thousands of feet wide, composed of many small faults with brecciated rocks (rock composed of angular fragments of older rocks melded together). The San Andreas Fault Zone is more than 800 miles long and extends to depths of at least 10 miles within the earth. It varies in width from a few hundred feet to a mile wide.

**Franciscan Complex** a common sedimentary rock(of the coastal range) which is a melange of chert, graywacke, blueschist, pillow lavas, and serpentine in a shale matrix

**Gabbro** a coarse grained igneous rock in which olivine and pyroxene are the predominant minerals and plagioclase is the feldspar present (quartz is absent)

**Gneiss** a coarse-grained, light and dark colored metamorphic rock that commonly has alternating bands of light and dark-colored minerals

**Granite** a coarse-grained intrusive igneous rock with at least 65% silica. Quartz, plagioclase feldspar and potassium feldspar make up most of the rock and give it a fairly light color.

**Greenstone** a metamorphic rock derived from basalt or chemically equivalent rock such as gabbro. Greenstones contain sodium-rich plagioclase feldspar, chlorite, and epidote, as well as quartz. The chlorite and epidote make greenstones green.

Vocabulary

| | |
|---|---|
| **Igneous Rocks** | rock formed when molten rock (magma) has cooled and solidified (crystallized). |
| **Lithosphere** | the outer 100km of the solid earth, where rocks are harder and more rigid than the layer below the lithosphere (known as the asthenosphere) |
| **Marble** | a metamorphic rock made of calcium carbonate. Marble forms from limestone by metamorphic recrystallization. |
| **Metamorphic Rocks** | a rock that has undergone chemical or structural changes produced by increase in heat or pressure, or by replacement of elements by hot, chemically active fluids. |
| **Offset Stream Course** | a stream whose drainage pattern is altered or offset as it crosses an active fault |
| **Plate Tectonics** | the theory that the Earth's outer shell is made up of about a dozen lithospheric plates that move about and interact at their boundaries. |
| **Sag Pond** | a low spot formed adjacent to the fault which can fill with water. |
| **San Andreas Fault** | an active strike-slip fault in Western United States, forming the on-land portion of the western margin of the North American Plate. |
| **Sedimentary Rocks** | sedimentary rocks are formed from pre-existing rocks or pieces of once-living organisms. They form from deposits that accumulate on the Earth's surface. Sedimentary rocks often have distinctive layering or bedding. |
| **Serpentine** | serpentine minerals are light to dark green, commonly varied in hue, and greasy looking; the mineral feels slippery. Rocks made up of serpentine minerals are called serpentinite. |
| **Serpentinite** | produced when hot sea-water circulates through the lithosphere at ocean ridges; it is usually found in regions where mountain-building events have occured in response to the closing of an ocean basin; also California state rock |
| **Shutteridge** | a ridge which is moved by the fault and blocks or shuts off the drainage of a creek. |
| **Stewardship** | choices and actions that protect our environment |



| | |
|---|---|
| **Subduction** | the process of one crustal plate sliding down and below another as the two converge; the subduction zone is the area between these two plates |
| **Syncline** | a downfold with a trough-like form |
| **Topography** | the shape of the land surface, including differences in elevation such as mountains, valleys, and rivers |
| **Transform Fault** | a strike-slip fault that offsets a midocean ridge in opposing directions on either side of an axis of seafloor spreading |
| **Tsunami** | an unusually large sea wave most often produced by an earthquake, volcanic eruption, or landslide out at sea. |
| **Uplift** | the raising up or displacement of surface features that occurs as a result of seismic activity. Mountain ranges are formed from uplift. |
| **Weathering** | the chemical alteration and mechanical breakdown of rock and sediment when exposed to air, moisture, and organic matter. The principal agent of chemical weathering is water solutions that behave as acids. Mechanical weathering involves physically breaking rock into fragments without changing the chemical makeup of the minerals within (example: water in cracks freezing and expanding, or changes in temperature that expand and shrink individual minerals enough to break them apart). |